TITLE OF THE INVENTION

Method of and System for Transferring Data over a Wireless Communications Network

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an improved method of and system for transferring data over a wireless communications network. More particularly, the present invention relates to an improved method of and system for transferring data from the Internet to wireless devices.

2. Description of the Prior Art

The Internet is a global computer network which comprises a vast number of computers and computer networks interconnected through communication links. The interconnected computers exchange information using various services, such as electronic mail and the World-Wide-Web (hereinafter, the "WWW").

The present invention relates particularly to the WWW portion of the Internet. The WWW allows a Web server to send graphical Web pages of information to a remote client computer system. The remote client computer system then displays the Web pages. Each Web page of the WWW is uniquely identifiable by a Uniform Resource Locator (URL). To view a specific Web page, a client computer system specifies the URL for that Web page in a request (e.g., a HyperText Transfer Protocol ("HTTP") request). The request is forwarded to the Web server that supports that Web page. When the Web server receives the request, it sends the Web page to the client computer system. When the client computer system receives

the Web page, it typically displays the Web page using a browser. A browser is a special-purpose application program that effects the requesting of Web pages and the displaying of Web pages. Commercially available browsers include Microsoft Internet Explorer™ and Netscape Navigator™.

Web pages are typically defined using HyperText Markup Language ("HTML"). HTML provides a standard set of tags that define how a Web page is to be displayed. When a user instructs the browser to display a Web page, the browser sends a request to the Web server to transfer to the client computer system an HTML document that defines the Web page. When the requested HTML document is received by the client computer system, the browser displays the Web page as defined by the HTML document. The HTML document contains various tags that control the displaying of text, graphics, controls, and other features. The HTML document may contain URLs of other Web pages available on that server computer system or other Web servers. Today, thousands of individuals, companies, educational institutions, government agencies and other organizations maintain Web sites which may be accessed and browsed through the use of a Web browser.

Typically, users will access the Internet via telephone lines or high speed data transmission lines hardwired to their computers. However, an expanding area of Internet access is wide-area wireless communications networks. Numerous companies throughout the United States, including Sprint and AT&T, offer their customers wireless Internet access via wireless devices such cellular phones, pagers, personal digital assistants (PDAs), etc.

However, because wireless communications networks have relatively low bandwiths as compared to other types of communications networks, and because most wireless devices have very limited capabilities with respect to the displaying of graphical images, the

transmission of graphics-intensive Internet documents in the wireless Internet context has generally proven unsatisfactory in that data transmission is often extremely slow and highly inefficient.

Additionally, in typical prior art systems, Internet documents are transmitted over wireless communications networks to the wireless devices without regard to the type of wireless communications networks to which the wireless devices are connected. Different types of wireless devices will transmit and receive data over different types of wireless communications networks. For example, one popular wireless communications network is the Mobitex network operated by Bell South Wireless Data in the United States. The Mobitex network is a packet data network that uses a proprietary non-IP packet format that must be converted to IP (Internet Protocol) for transmission over IP based networks. In addition, because of the low bandwidth of the Mobitex network, in order to achieve maximum performance, the packets should be paced over the network at an appropriate speed based on the capabilities of the network. By so doing, the waste and performance degradation associated with sending packets too quickly over the network is avoided, reducing both latency and financial loss to the Internet service provider caused by lost packets. Thus, data transmission without regard to wireless communications network type introduces additional delays and inefficiencies.

It is thus clear that there is a need for an improved method of and system for transferring data from the Internet to wireless devices which overcomes the problems associated with the prior art.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a new method of and system for transferring data from the Internet to wireless devices which overcomes the problems associated with the prior art. It is another object of the present invention to provide a new method of and system for transferring data from the Internet to wireless devices wherein data transmission occurs at higher speeds than in the prior art. It is yet another object of the present invention to provide a new method of and system for transferring data from the Internet to wireless devices wherein data transmission is more efficient than in the prior art. It is yet another object of the present invention to prove a new method of and system for transferring data from the Internet to wireless devices wherein data transmission is informed by the type of wireless communications network to which the wireless device is connected. Additional objects will become apparent from the following discussion.

In accordance with the present invention, a client wireless device running a client process and a Web server running a server process are provided. The wireless device and Web server are configured so that the wireless device user may access the Internet or other communications network (either public or private) over a wireless communications network through the Web server.

A wireless device user desiring to browse a Web page will send a request over the wireless communications network to the Web server via the client process using a transport protocol suitable for transmission over a low bandwith network. The protocol includes an element which identifies the type of wireless device making the request and the type of wireless communications network to which the wireless device is connected. The Web server receives the request from the wireless device, reformats the request into a fully qualified

HTTP request suitable for transmission over the Internet, and transmits the reformatted request over the Internet to the destination server containing the desired Web page. The destination server receives the request and returns the requested Web page to the Web server. As the Web page is received by the Web server, the server process parses the Web page to remove data that is not displayable on the wireless device based on the wireless device type. The parsed Web page is then transmitted over the wireless network in data packets to the wireless device where it is displayed for the user. Packet pacing is determined by the wireless network type.

The present invention will now be described in greater detail, with frequent reference being made to the drawings identified below.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

figure 1 is a schematic diagram of a system for wireless Internet access in accordance with an embodiment of the present invention;

figure 2 is a block diagram of a wireless device in accordance with an embodiment of the present invention;

figure 3 is a block diagram of a Web server in accordance with an embodiment of the present invention;

figure 4 is a flow chart showing how a request is transmitted from the wireless device to the Web server in accordance with an embodiment of the present invention;

figure 5 is a flow chart showing how the request is processed by the Web server in accordance with an embodiment of the present invention;

figure 6 is a flow chart showing how the requested Web page retrieved from the Internet is processed by the Web server in accordance with an embodiment the present invention; and

figure 7 is a flow chart showing how the requested Web page is processed by the wireless device for display in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The following description is presented to enable any person of ordinary skill in the art to make and use the present invention. Various modifications to the preferred embodiment will be readily apparent to those of ordinary skill in the art, and the principles defined herein may be applied to other embodiments and applications without departing from the spirit and scope of the present invention. Thus, the present invention is not intended to be limited to the embodiment shown, but is to be accorded the broadest scope consistent with the principles and features disclosed herein.

Referring to figure 1, a system 10 for wireless Internet access is shown. The system 10 includes a wireless device 12, such as a cellular phone, pager, PDA, laptop computer, or the like, which a user may use to access the Internet 18; a wireless communications network 14; a Web server 16 connected to the wireless device 12 via the wireless communications network 14 as well as the Internet 18; and a destination server 19 on the Internet from where a Web page will be retrieved and sent to the wireless device for display.

It will be readily apparent to those of ordinary skill in the art that although the present discussion focuses on the Internet, the present invention is not limited to the Internet, but may be used in connection with any private or public IP or non-IP communications network.

Referring to figure 2, a block diagram of a typical wireless device 12 in accordance with the present invention is shown. The wireless device 12 includes a central-processing-unit (CPU) 20 for controlling the operation of the device; a random-access-memory (RAM) 22; a read-only-memory (ROM) 24; a hard drive 26 which includes an operating system 28, a Web browser 30 and a client process 32; an input device 34, such as a keyboard; a display 36, such as liquid-crystal-display (LCD); and a wireless modem 38 for interfacing with the wireless communications network 14.

Referring to figure 3, a block diagram of a typical Web server 16 in accordance with the present invention is shown. The Web server includes a CPU 42; a RAM 44; a ROM 46; a hard drive 48 which includes an operating system 50, Web server software 52, communications protocols 54, a server process 56 and a child process 58; a network interface 60 which connects the Web server 16 to the wireless communications network 14; and an Internet interface 62 which connects the Web server 16 to the Internet 18.

The operation of the system of figure 1 will now be described. Referring to figure 4, the user of the wireless device 12 will input a request into the Web browser 30 using the input device 34 (step 100). The request will typically consist of a URL for a Web page of interest to the user, but may be any type of request for any type of data. After the request is input, the client process 32 will format the request in accordance with a transport protocol suitable for transmission over a wireless communications network, such as one based on UDP/IP (step 102). Importantly, the transport protocol includes an element which identifies the type of wireless device making the request and the type of wireless communications network over which the request is being transmitted. The request is then transmitted over the wireless communications network 14 to the Web server 16 (step 104).

Referring to figure 5, upon receipt of the request by the Web server 18, the server process 56 first determines the type of device that has made the request (step 106). Once that determination is made, the server process 56 spawns the child process 58 which reformats the request into a fully qualified HTTP request suitable for transmission over the Internet (step 108). After reformatting the request, the server process 56 transmits the HTTP request over the Internet to the destination server 19 (step 110).

Referring to figure 6, upon receipt of the request from the Web server 18, the destination server 19 returns the requested Web page to the Web server 18 (step 112). Typically, the requested Web page will be in HTML or another popular Internet format. As the Web server 18 receives the Web page, the child process 58 parses the Web page to remove any data that is not displayable on the wireless device 12 (step 114). The data that are removed from the Web page are dependent upon the wireless device type. Thus, for example, if the device is a pager that is not capable of displaying JPG files, then any JPG files will be removed.

After parsing, the child process 58 reformats the Web page by building tags containing the remaining data (step 116). Preferably, the tag language used will be HTML since HTML is the most well-known and popular Internet tag language. However, those of ordinary skill in the art will realize that browsers on some wireless devices, such as pagers and PDAs, may not be capable of displaying HTML documents. In that case, a tag language compatible with the particular browser must be used.

The reformatted Web page is then written to a file and stored in RAM 44 or on the hard drive 48 (step 118). After that, the file is compressed, encrypted and transmitted over the wireless communications network 14 for delivery to the wireless device 12 by the server

process (step 120) in data packets. Because the type of wireless network to which the wireless device is connected is known, the data packets are paced by the server process at a rate best suited for transmission over the particular type of network.

Referring to figure 7, once the file is received by the wireless device 12, the client process 32 first decrypts (step 122) and then decompresses (step 124) the file. The client process 32 then reads the tags of decompressed, decrypted data, interprets their contents, and displays the parsed Web page to the user in the browser 30 window on the display 36 (step 126).

The present invention has numerous advantages over the prior art. Because the Web page transmitted to the wireless device is greatly simplified from its original form, the size of the Web page is greatly reduced, resulting in a reduced transmission time over the wireless communications network. Additionally, because the Web page transmitted to the wireless device does not have any non-displayable elements, the transfer is extremely efficient since there is no transmission of superfluous data. Additionally, because the type of wireless communications network is known to the Web server 18, it is possible to pace the data packets at an optimal rate to provide a faster and more efficient data transfer.

It will be apparent to those of ordinary skill in the art that the present invention may readily implemented using computer programming techniques well known to those of ordinary skill in the art. It will be further apparent to those of ordinary skill in the art that the present invention is extremely versatile and may be modified and used in a virtually unlimited number of ways without departing from the scope of the claims attached hereto.

Thus, in accordance with the foregoing the objects of the present invention are achieved. While modifications to the present invention may be obvious to those of ordinary

skill in the art, the invention so modified would not be beyond the scope of the appended claims.